Name: _____ Period: _____ Date: _____

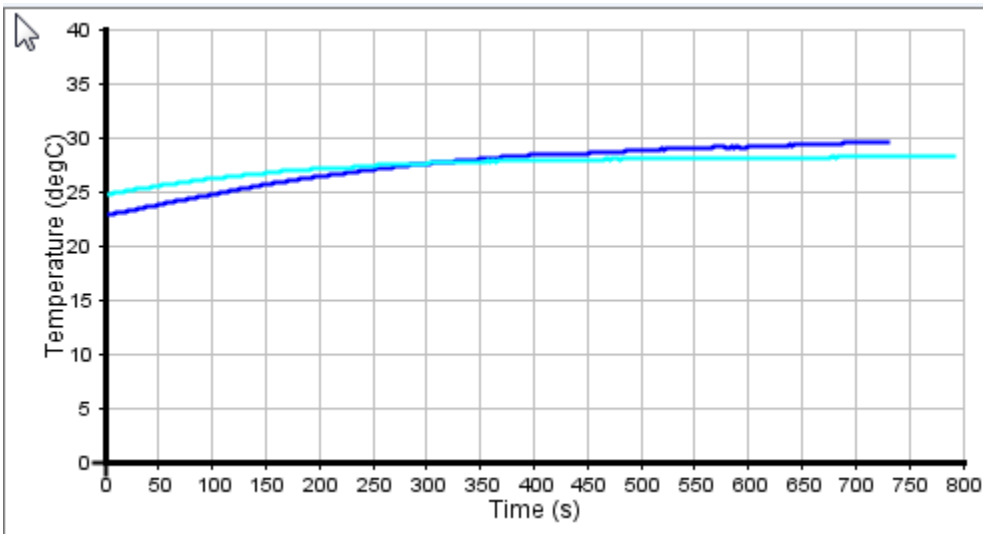
What causes the Seasons? - Part I

Part A: Temperature Probe (Conducted as a Demonstration; Work on Part B while waiting.)
Using a temperature probe, graph the temperature of a light source perpendicular to black paper. Repeat with the paper angled.
Data:

Key:

Indirect Light

Direct Light



Questions:

1. Was the change in temperature greater when the paper was perpendicular to the light or at an angle? Perpendicular to the paper.

2. In which case is the light most intense, and in which case is the light least intense? The light is most intense when the angle was 90° and least intense when the angle was 45°.

3. How is the intensity of the light related to the change in temperature? Support your answer with the data collected. The intensity of the light is related to the change in temperature because the data indicates that when the board was perpendicular, there was a greater change in temperature and direct light. The change in temperature, according to the data was 7°C. When the angle changed there was indirect light, or less intensity, the change in temperature was 3C°.

Part B: Flashlight (To be completed while part A is running.)

Purpose: To discover what makes summer warmer than winter.

Materials: flashlight graph paper protractor

Procedures:

1. Place a piece of graph paper on the table.

2. Hold a flashlight perpendicular to the table about 2 cm from the paper.

3. Have another student trace the outline of the flashlight on the graph paper.

4. Split the circle into 4 and count the number of squares within the tracing. If there is a partial box, count it as 1/2 of a box.

How many boxes are in the perpendicular tracing? 256 boxes

5. Angle the flashlight so that the light covers the circle but fits on the paper. Keep the flashlight the same distance from the table (5 cm) as in #2 above.

6. Have another student trace the outline of the flashlight on the graph paper.

7. Split the oval into four and count up the number of squares within the tracing. If there is a partial box, count it as 1/2 of a box. Don't forget to add in the original circle.

How many boxes are in the tracing at 25°? 425 boxes

Questions:

4. Define intensity: The strength of the light.

5. How do the number of boxes relate to the intensity of the patch of light? Keep in mind the actual light in the flashlight did not change, only size of the tracing on your paper.

   The greater number of boxes indicates less intensity. The smaller number of boxes indicates more intensity.

6. When is the light least intense? When the flashlight was on an angle.

7. How does the angle affect the intensity of the light? **Support** your answer using the number of boxes you counted above.

   The angle creates more boxes covering a larger area, thus showing less intensity.

   When the light is less intense, there were 256 boxes. When the light is perpendicular, there were fewer boxes covering a smaller area, thus showing more intensity. When the light is more intense, there were 425 boxes.

Part C: The Earth and Sun Computer Model (projection mode or go to http://projects.astro.illinois.edu/data/Seasons/seasons.html)

Procedure:

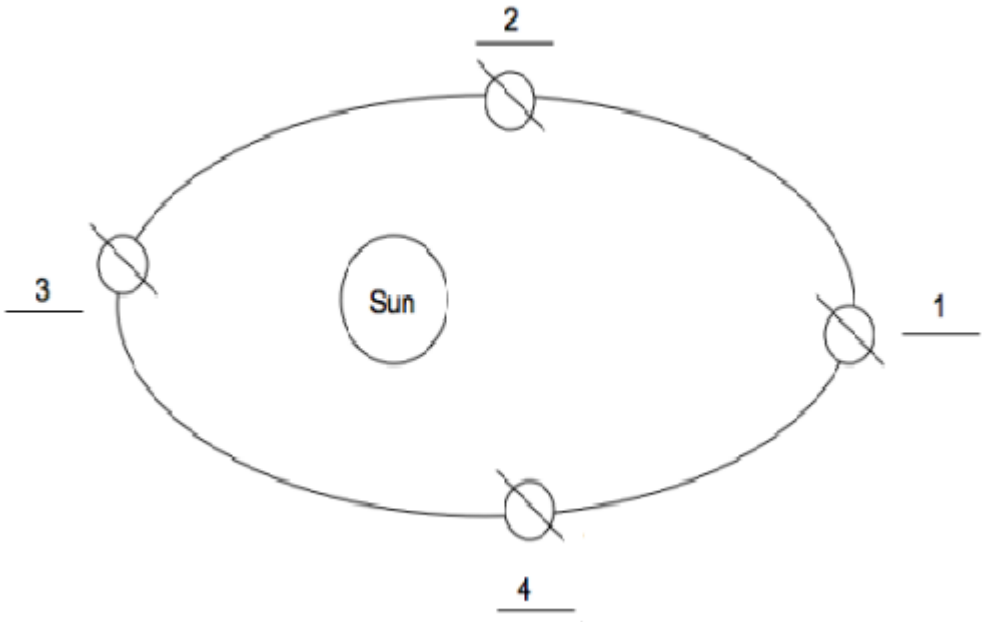
1. Examine the Earth and sun computer. Note the date and light intensity on the grid.

Questions:

8. What do you think the grid in the lower right of the Earth and Sun model is showing?

   The intensity of the sun projected on Earth.

This diagram will help you answer the questions that follow. Using the computer model of the earth and sun, answer all questions from the perspective of an observer in the northern hemisphere. Circle the letter of the best answer.



9. At position #1 the sunlight in the northern hemisphere is:

   ⓐ Most intense b. Least intense c. In between

10. At position #2 the sunlight in the northern hemisphere is:
    a. Most intense b. Least intense ⓒ In between

11. At position #3 the sunlight in the northern hemisphere is:
    a. Most intense ⓑ Least intense c. In between

12. At position #4 the sunlight in the northern hemisphere is:
    a. Most intense b. Least intense ⓒ In between

13. The season depicted at position #1 in the northern hemisphere is:
    a. Spring ⓑ Summer c. Autumn d. Winter

14. The season depicted at position #2 in the northern hemisphere is:
    a. Spring b. Summer ⓒ Autumn d. Winter

15. The season depicted at position #3 in the northern hemisphere is:
    a. Spring b. Summer c. Autumn ⓓ Winter

16. The season depicted at position #4 in the northern hemisphere is:
    ⓐ Spring b. Summer c. Autumn d. Winter

17. Using what you have learned, describe the intensity of the sun in Rhode Island in each of the four seasons. Consider when the sun is more intense or less intense. Summer-most intense; Winter-least intents; Spring and Fall-in between

18. Run the model of the sun and Earth again. Notice how the distance between the Earth and the sun varies throughout the year. When is the Earth the closest to the sun? The Earth is closest to the sun during winter.

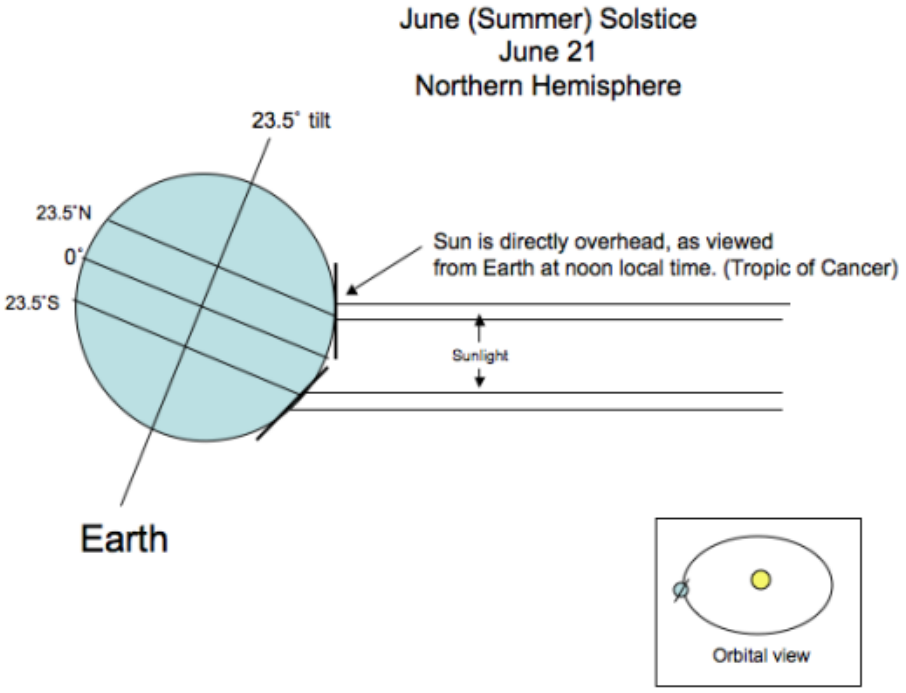
19. When is the Earth furthest away from the sun? During summer

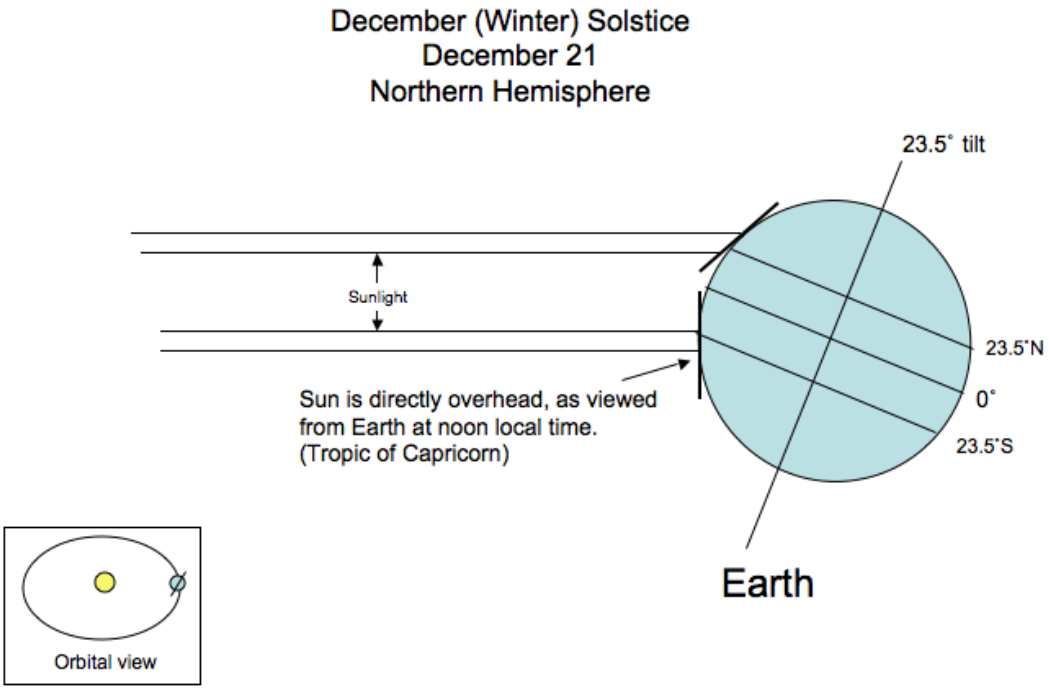
20. Is this what you expected? (Your opinion)

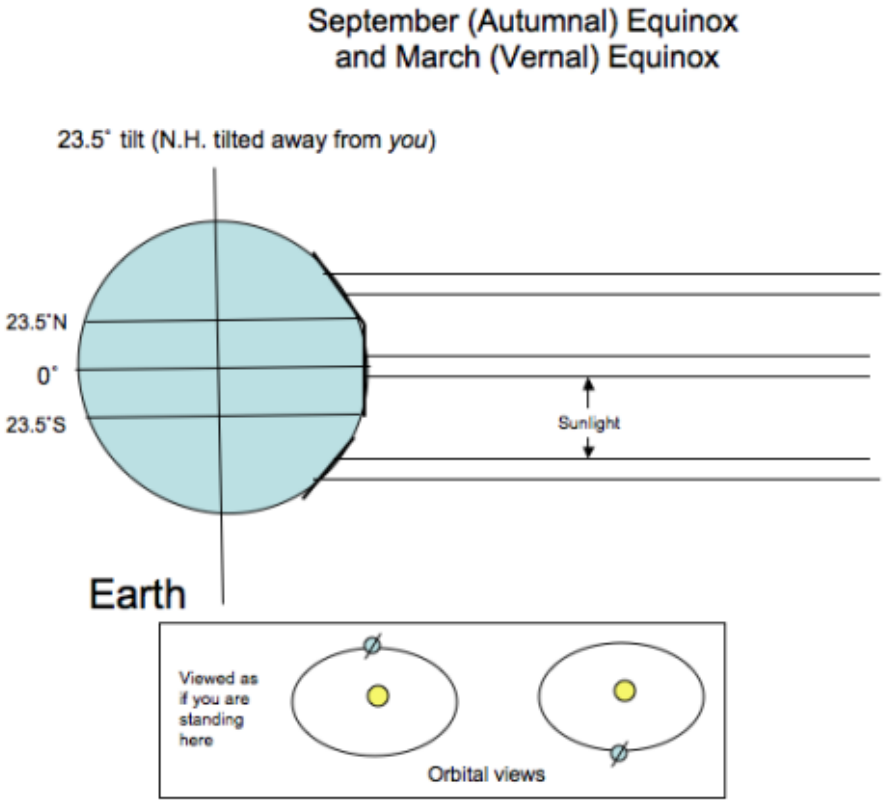
21. Does the evidence you have so far support the idea that the difference in the intensity of the sun explains the reason why we observe seasons on Earth? (Your opinion)

Name: _____ Period: _____ Date: _____

Directions: Examine the three diagrams below. Then answer the questions that follow. Circle the letter of the best response.







1. When is the sun directly overhead at the equator?
   a. June (Summer) Solstice
   ⓑ Spring Equinox and Autumnal Equinox
   c. December (Winter) Solstice

2. When is the sun directly overhead at 23.5°N latitude?
   ⓐ June (Summer) Solstice
   b. Spring Equinox and Autumnal Equinox
   c. December (Winter) Solstice

3. When is the sun directly overhead at 23.5°S latitude?
   a. June (Summer) Solstice
   b. Spring Equinox and Autumnal Equinox
   ⓒ December (Winter) Solstice

4. Using the diagrams, how many times a year is the sun directly overhead at the equator? Twice-fall and spring